continuous with the coat in question, the raphe *being a mere thickening of that coat,* in all the cases which have come under our observation. We have never seen such conditions as are represented in fig. 1 of Mr. Miers's paper, where the testa is shown distinctly separated from the raphe (or placental sheath). The cellular structure is uninterrupted between raphe and testa where the two are in contact, and the line of division running down between *b* and *c* has no existence in any case that we have observed.

7. Consequently there is no necessity that branches of the raphal vessels must set out from the gangylode or chalaza to enter the testa; they may be sent out laterally in any part of the raphe between the hilum and the chalaza.

8, 9 and 10 fall away, if the foregoing statement be correct. We do not venture to assert that it is universally true, but it is the correct account of what we have found to exist in a large number of cases.

As regards specialities referred to in the paper, we must declare in favour of the superior value of such evidence as that furnished by Dr. Gray, in the case of *Magnolia,* to any analogical reasoning, which, in the case of the changes occurring during the maturation of seeds and fruits, is a most unsafe guide. And when Mr. Miers finds a difficulty in comprehending how an originally homogeneous tunic becomes developed into a double layer, one hard and the other soft, we think he must have overlooked the familiar case of the fruits of the *Amygdaleæ,* where the stone and pulp are clearly produced from the simple pericarp.

The cases where a branching of the vascular structure from the hilar end of the ovule takes place, are most simply explained on the above grounds, as developments within the substance of the testa; and the "placentary sheath" is a needless assumption. In the case of *Citrus,* where the branching vessels start from the chalaza, they ramify in the *tegmen,* or inner coat, as this is only organically continuous with the outer tunic and raphe at that point.

April 3rd, 1858.

XXXIV.—*Further Observations on the Nature and Origin of the External Coatings of Seeds.* By John Miers, F.R.S., F.L.S. &c.

The arguments which I lately offered, relative to "the nature and origin of the external coatings of seeds," are founded principally upon the facts recorded by the most eminent physiological botanists, who have described and figured the gradual

progress of the increment that occurs, from the earliest period of the growth of the ovule, to the final ripening of the seed. The most important inference I have there deduced, is, that the external coating of the seed in which the vessels of the raphe are imbedded, derives its origin, not from that which should be considered as the true primine, or outer original tunic of the nucleus, but from an extraneous sac that subsequently grows over that tunic, and which is developed from its funicular support, which I have termed the placentary sheath: in confirmation of this inference, I now proceed to show the manner in which this growth is effected. Wishing to submit the truth of this deduction to the test of observation, I examined lately the growth of the ovule of the Almond, as that is the instance to which I referred, showing the manner in which the vessels of the raphe become distributed over the whole area of its seminal tunic: the result proves the correctness of my inference in regard to the nature and origin of the external coating first mentioned, for I had previously no evidence to demonstrate how and when it was produced.

At the earliest stage observed in the cell of the ovary, the placenta throws out two small bracket-like protuberances, each being the germ of a placentary sheath, and near its extremity there is seen to sprout a small mammillary knob, which is the rudiment of the nucleus: this nucleus, continuing to grow, is soon surrounded at the point of its origin by two small cups: by degrees, the surface of the sheath on which these cups rest becomes channeled, and then more deeply grooved; at which period we may discern, within the body of the sheath, the nourishing vessels essential to the growth of the ovule, proceeding from the placenta and terminating at the point where the nucleus and its distinct cups are attached to it, which point I have called the gangylode. The grooved surface of this support now continues to extend, not at its margin, which scarcely increases, but by the growth of its middle portion, which, expanding downwards, forms at first a shallow, and gradually a deep cup, in the progressive manner shown in the marginal figures (fig. 1), until at length we see it formed into an oblong open pouch, within which is seated the nucleus, partly enclosed in its proper tunics: during this transformation, it will be observed that the margin of the grooved channel of the ovular support, which now becomes the mouth of the pouch, has never changed its original position, remaining on the same level, and in the same contiguity to the placentary point, out of which the support first issued. Here we see produced what is termed an inverted or anatropal ovule: it is, however, important to observe, that in this action the ovule undergoes no inversion whatever;

Fig. 1.

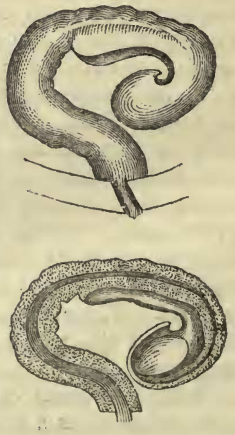
so that the term anatropal has, in fact, been erroneously applied to it, in consequence of a misconception that has originated in the want of attention to the manner in which this mechanical process of growth is effected. By this beautiful and most simple contrivance of Nature, the apex of the nucleus is brought into close proximity to the orifices of the stigmatic channels, there to receive the pollinic influence held to be essential to the generation of the embryo, prior to the final closing of the orifices of the surrounding tunics over it. Subsequently the mouth of the extraneous pouch of the placentary sheath also closes up, and this pouch then assumes the form of an entire coating, as in *Magnolia*, or it occasionally remains pervious, as in *Euonymus*; but we invariably find the nourishing vessels imbedded within its tissues. In ordinary cases these vessels remain as one continuous cord, similar to that first generated within the sheath terminating in the chalazal point, and thus constituting a simple raphe; but in others, like that of the Almond, they divide and spread themselves over the whole breadth of the tissues of the pouch, and form at length a branching raphe. By such simple means all the phænomena attendant upon what is called anatropal inversion are fully understood and explained; and we are thus relieved from the necessity of imagining the more complicated action of the twisting of the ovule round its funicle, and the paradoxical circumstance assumed to take place, of the insinuation of the nourishing vessels into the tissues of the original tunics of the nucleus; for it is clear to me, that all the objections I have urged (*ante*, p. 278) hold good on the assumption generally entertained that the ovule inverts itself, and that in this action its apex is turned round to the point where its base formerly stood, and *vice versâ*; the consequence of which is the production of the raphe upon one of its sides. These objections, however, entirely disappear under the view of the actual circumstances that occur in the manner here shown.

Under this point of view, it is clear that the presence of a raphe, whether as a simple cord, or in a branched state, within the tissues of a seminal coat, indicates with certainty that such

coat has emanated from the growth of the placentary expansion that served as the support of the ovule, and that it has not been developed from one of its proper tunics. Such is the coating I call an *arilline*, in contradistinction to the *testa*, or development of one of the proper tunics of the nucleus, which becomes an integument always devoid of vessels, and generally crustaceous in its texture, whence its name has been assigned; but as this is often reduced to the tenuity of a membrane, sometimes agglutinated to the tegmen, and frequently to the arilline, as in the Almond; or as it sometimes happens that a still more extraneous coating or arillus, formed over the arilline, or possibly the arilline itself, assumes the crustaceous form of the ordinary testa, great misconception has existed in regard to the origin of such integuments, and much confusion has ensued in the terms applied to them. It is true that the pouch or expansion of the placentary sheath above described has often been confounded with, or denominated, the primine; but that does not influence the real state of the case, for in this investigation we must depend solely upon *facts*, that is to say, upon the nature of the integuments themselves, rather than upon the *designations* which botanists have often confusedly applied to these different developments. It was therefore with the object of ascertaining the real nature of the several kinds of seminal integuments, that I entered into this investigation; and in now bringing it to a close, I will subjoin the following elucidation of the real source of the peculiar development which I have above described.

The expansion of the placentary sheath and the peculiar growth of the arilline offer well-marked characters in many families, and these developments take place under very striking circumstances in the *Anacardiaceæ*. It has been assumed, as one of its leading features, that its solitary ovule is always suspended from a long free thread that rises from the base of the cell; this, however, very rarely happens, as I will show in a memoir where the structure of the Order is examined, and characters are given of its various South American genera. I now exhibit in the margin a drawing (fig. 2) of what I have observed in *Pistacia Atlantica*, that genus offering one of the few cases where the funicle rises from the very base of the cell: to this is added a section of the same. Here the cord of nourish-

Fig. 2.



ing vessels, after penetrating through the pericarpial envelopes, suddenly expands into a broad fleshy sheath, in the tissues of which the cord of the raphe is continued till it terminates in the chalazal point of the partly-formed seed: this very elongated sheath is coiled round in a spiral form, and near its extremity there is seen a very deep groove, which terminates in the small open mouth of an oblong pouch, which is a continuation of the sheath, and in which the ovary with its closed tunics is affixed at its base. In this instance, the flower had long before withered, and the ovary had grown to a considerable size, being now above 3 lines in length. Here we have proof of the peculiar nature of the long placentary sheath, and of its pouch-like development: the perfect resemblance of the latter to the analogous pouch above described, as seen by me in the ovule of the Almond, is convincing; and we have here evidence that this pouch can in no way be considered as one of the original tunics of the ovule, and therefore cannot be held to be the primine. I annex the figure of another very instructive example (fig. 3), observed in an abortive ovule of a species of *Drimopus*, the whole of which being transparent, affords a proof of the real structure: here the placentary sheath is straight, and suspended from near the summit of the cell; its lower portion is grooved, and the margins of this groove terminate in the open mouth of an oblong sac, which is an extension of the sheath, similar to that seen in *Pistacia*. We observe at the base of the included nucleus, which is also surrounded by its two open tunics, the common point of their attachment to the bottom of the pouch, in which point we see the termination of the raphe, which thence is traced along the sheath to the place of its origin in the placenta.

Fig. 3.

XXXV.—*On some new Genera and Species of* Crustacea amphipoda. By C. Spence Bate, F.L.S. &c.

Among the Edriophthalmous Crustacea belonging to the Collection of the Royal College of Surgeons, which have been entrusted to me for examination, the following appear hitherto to have escaped being described.

Macrocephalus, n. g.

Cephalon horizontaliter porrectum. *Antennæ* inferiores nullæ.